

MACRO Letter

Announcing
Solutions For
Flexible Film

Summer 2010

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Prestretched Film Production in a Single Shot

By Andrew Erskine

Stretch films have been used for decades as an efficient and inexpensive way to secure items for transport. Applied by machine, or by hand, these films are unwound from rolls, stretched

and then wrapped around items to be secured. By stretching the film before wrapping the load, energy is stored in the molecular bonds of the film. This energy tries to shrink the film back to its original form causing the film to cling tightly to the load and secure it in place.

Machinery Spotlight

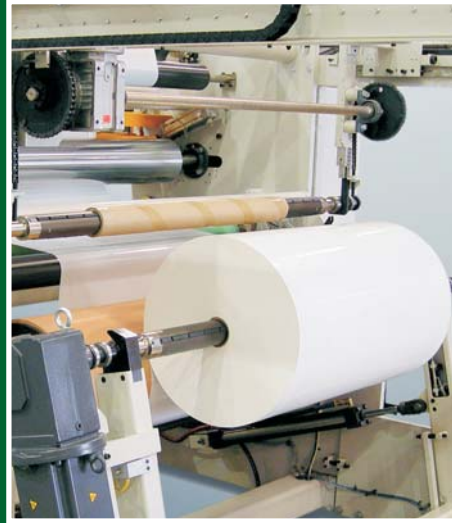


New Patent for Macro's D10 PRO Automatic Air Ring

Macro has received a new patent for its recently upgraded D10 PRO automatic air ring.

The latest upgrades to the D10 PRO were created to simplify the operation of the air ring. Upgrades included new valves and motors for each control zone to improve reliability and redesigned software for faster and simpler startups. Installation has also been simplified by replacing heavy connection cables with a pair of light power and communication cables.

Macro utilizes two general scanning methods with the D10 PRO; a traditional rotating scanner system that senses the film thickness as the bubble rises in the tower, and a flat scanner system that takes film thickness readings after the bubble has been collapsed. "Both systems provide advantages," states Macro's R&D Director, Felix Guberman. "The flat system allows the use of a wider range of non-nuclear scanners such as infrared, X-ray or ultrasound and can complete scans quicker. The rotating scanner setup requires less complicated setup and software."



Vacuum Drum = Zero Foldover Roll Transfers

Macro has developed a specially designed vacuum drum to improve control during roll transfers on their AUTOMAX-S surface winders.

The vacuum drum contains strategically positioned perforations that allow air to be drawn towards its surface. This forces the film to adhere to the drum as the winder's cut and transfer cycle is executed. Also incorporated into the sequence is a specially designed cutting arm assembly that rotates by cam in synch with the drum.

The result is zero foldover transfers with perfectly straight cuts resulting in web entirely useable right to the core.

The vacuum drum can be added to certain winders as an optional feature. It is particularly effective for single or 3-layer PE films with thickness of 25-150 microns.

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The film also clings to itself to provide additional gripping strength and ease in application.

Stretch films are produced on both cast extrusion systems and blown extrusion systems. Typically, cast processes produce stretch films that are both clear and glossy, and have double or triple the production capacity of blown lines, which can make justifying the return on investment easier. The key advantage for producing stretch films with the blown process is the mechanical properties they exhibit. They have much-improved puncture and tear resistance; qualities that are ideal for stretch film applications where films are stretched significantly in the machine direction.

Prestretched Film Rolls

Prestretched films have evolved from traditional stretch films as they provide several benefits that give them an advantage over standard stretch films. Prestretched film, as the name suggests, is film that is pre-stretched prior to it being wound into rolls for final use. This means the film doesn't require as much stretching energy as a standard stretch film to achieve the same wrapping force; a key reason why prestretched films are popular for hand wrap.

The rolls are generally light and easy to handle, reducing operator fatigue. Operators also benefit by being able to use a walk-forward wrapping technique, which can help prevent slip and fall incidents.

In terms of material costs, prestretched films are much thinner than traditional stretch films. This provides savings in resin costs and produces less waste as the operator uses less material during application.

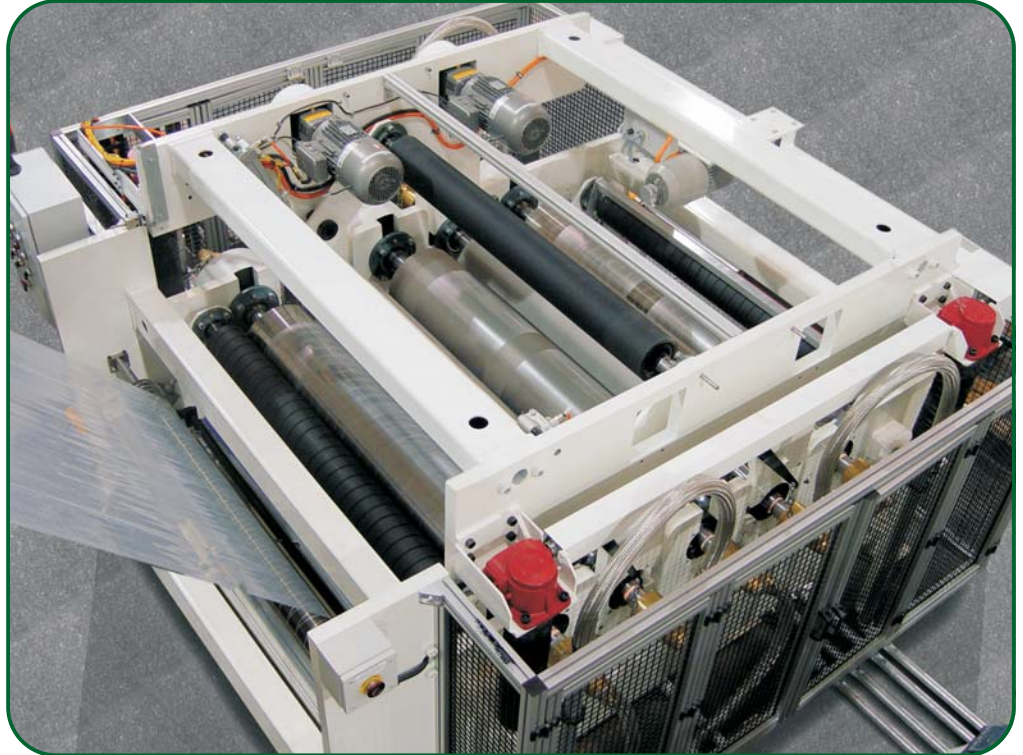
Macro's goal to enter the prestretch film market was to develop a blown film system to produce superior quality prestretch film rolls in a single process. To meet the goal the film had to be stronger and thinner but with strong edges that prevent tearing. The line was to take no trims to save on material and reprocessing costs. The rolls were to be wound with little tension to create light, soft rolls that are easier to handle and less likely to be damaged. The line was to be a single inline extrusion, stretching, slitting and winding system, all automatic. This was achieved with Macro's Blown Prestretch (BPS) Film Line.

The BPS Advantage

Macro's BPS Line creates soft, lightweight prestretched rolls that are easy to unwind and suitable for machine and hand wrapping applications. The patented process is based on an uncomplicated single-layer blown film method using an inexpensive, butene-based LLDPE with an appropriate amount of PIB or tackifier. The film is immediately tacky without the need for additional conditioning or special storage.



Monolayer die and D10 air ring producing an evenly gauged, perfectly cooled bubble



The slitting and stretching unit creates multiple lanes of film with precisely controlled stretch

The Extrusion Process

The extruded bubble is collapsed at a low height and blocked to create a 2-ply film. This 2-ply structure provides an extra layer of strength; if there is a defect in one ply the other will cover the load. Also, line start-ups are simplified, and less time consuming as the need for individual layer separation is eliminated.

The film is then slit either 2-up or 4-up and sent to an inline stretching unit where it's thinned to 6 or 7 microns of total thickness. To retain tear strength, the stretching unit leaves the edges of the film 40-80% thicker than the rest of the film.

No trims are taken, and no scrap is created in the process. The combination of very thin film, created with inexpensive resins, and no trim or scrap generates significant savings to the processor. Not

BPS Advantage

- Single process from resin to sellable rolls
- Inexpensive resins
- No trim, no reclaim, no waste
- Soft, lightweight rolls
- Very thin film (6-7 microns)
- 2-ply film
- Blown film strength
- Thick edges for extra resilience
- Excellent gauge
- Tacky
- Low tower height

only does the processor use less resin, which is also less expensive, there is also no need for costly reclaim and conveying systems to collect trims.

Soft Ready to Use Rolls

The film is wound on a fully automatic turret winder that is specially designed for winding soft rolls at a production speed of 500 m/min. These soft rolls are created by reducing the winding tension and deliberately entrapping air between the winding layers.

Soft rolls provide several advantages over conventional stretch film rolls:

- *The rolls require less energy to unwind; making hand application easier and reducing operator fatigue.*
- *The rolls are more resilient than hard rolls; the edges will not damage if the roll is dropped.*
- *The rolls are lightweight, making them easier to handle and also less likely to cause injury if dropped on the operator's foot or hand.*



Soft rolls provide many opportunities to improve plant safety and cost savings

The process can be adjusted for multilayer film production using inexpensive butene copolymers in the center layer and metallocene or plastomers in the outside layers.

Macro has been awarded two US patents for this technology. To learn more about Macro's BPS line visit our website – www.macroeng.com.



Automatic cut and roll transfer of soft prestretch film rolls on Macro's BPS Line

Booming Business Leads to 40% Plant Expansion



Macro has expanded its production facilities to accommodate a recent boom in sales activity.

Following predictable subpar sales through 2009, Macro's sales have excelled over the last three months, returning the company to the record setting sales levels it had enjoyed in 2008. The elevated workload has led Macro to expand to a neighboring building to make room for the extra production. The building, which will increase Macro's production floor space by approximately 40%, will be used mainly for setting up and testing machinery prior to shipment.

Macro has also increased its employee base by 35% since December, to help handle the elevated workload.

"Sales have been taken for a variety of machine types ranging from multilayer blown film lines, to specialty extrusion systems, to custom-built winding equipment," states Andrew Erskine, Macro's Sales & Marketing Coordinator. "The orders are from both local and global customers with European, South American, Chinese, Canadian and U.S. markets being the most prominent."

Customer Interest

A Process to Benefit Both the Supplier and the Customer

By Terry Rego
Area Sales Manager

When Macro Engineering & Technology embarks on a new project with existing or new customers the sales process of *customer interest* is of paramount importance. Customer interest is the ability to get to know the customer and the needs of the customer in as much depth as possible. At Macro, sales is approached from a project point of view. Macro has extensive experience and capabilities to offer not only complex extrusion systems but can also guide a customer through the process of purchasing a new line and advise on what materials are to be used for producing the film and discuss with customers the film structures to meet their end uses.

The wealth of experience within Macro is built upon a solid production process that is combined with an extensive understanding of raw materials, film structures and machine configuration. Macro also has a committed R&D department and can offer customers development time on our extrusion machinery to test new film structures and review quality, physical properties and production outputs. This service provides a significant advantage to our customers before committing to a new investment.

Customer interest also takes into account the future business of the customer. Macro can assist in providing information to determine the customer's return on their investment. We often identify and discuss with customers the products and markets that we perceive to have potential opportunity for growth. With no commitments, Macro can also discuss new technologies with customers.

Customer interest involves interaction with as many departments within the

customer's operations so all areas of concerns can be addressed. A typical example would be a small, privately held company prepared to order a new line with only the involvement of the owners. Production and engineering staff may not get ample opportunity to have input on the configuration of the machine. Through Macro's sales process, we reinforce the importance of involving as many departments of the customer to help find the best possible configuration of the line before the purchase is made. Lessons learned by customer's production, quality and engineering staff go a long way to successful design of a line that meets all requirements.

Customer interest involves taking the time to visit the customer's plant and engulf ourselves in the customer's world. By doing so Macro can develop and offer systems that customers may not realize to be possible; creating a mutualistic benefit for both the customer and supplier. With a deeper understanding of the customer's needs and challenges we can focus on innovations that have real value for the customer and help ensure the ongoing success of both parties involved.



*K-2010 International
Trade Fair is just
around the corner.*

Be sure to drop by Macro's booth to discuss the latest trends and technology.

Hall 16, Booth A18



Tight Squeeze Installation

Macro recently installed a 3 m wide, 3-layer blown film line into a space-limited production facility. The footprint of the line had to be drastically compacted during the engineering process to accommodate the tight space it was to be installed in. Onsite alterations had to be made and careful supervision was imperative to the success of the installation.

"It was a challenging project", said Steve Szabo, a Project Manager at Macro who oversaw the installation. "We had to make many adjustments at the site to make the line components fit with allowable clearances for moving components. Ducting and other utility arrangements had to be repositioned to allow for safe operation of the line and access routes for the operators."

The line was installed a mere 60 cm (2 ft) from a preexisting blown film line (seen above with white film). Under Macro's supervision, production on the adjacent line was never affected during the installation. This is just another example of how Macro will go the extra distance to ensure customer satisfaction.

Coextrusion Quick Reference Sheet

MACRO Letter

Barrier Properties*

* Values are based on typical resins and may vary depending on specific resin grades

| Material | Density (g/cm ³) | Melting Temp (°C) | OTR ¹ | WVTR ² | Melting Temp (°F) | OTR ³ | WVTR ⁴ |
|-------------------|------------------------------|-------------------|------------------|-------------------|-------------------|------------------|-------------------|
| VLDPE | 0.910 - 0.915 | 118 - 125 | 300 | 0.52 | 244 - 257 | 780 | 1.3 |
| mPE | 0.880 - 0.910 | 90 - 105 | 235 - 470 | < 1.00 | 237 - 255 | 600 - 1200 | < 2.5 |
| LDPE | 0.915 - 0.925 | 108 - 115 | 163 | 0.40 - 0.48 | 226 - 239 | 420 | 1.0 - 1.2 |
| EVA 4% | 0.926 | 90 - 105 | 156 - 234 | 0.60 - 1.60 | 194 - 221 | 400 - 600 | 1.5 - 4.0 |
| LLDPE | 0.915 - 0.940 | 118 - 125 | 170 | 0.32 - 0.48 | 244 - 257 | 440 | 0.8 - 1.2 |
| MDPE | 0.926 - 0.940 | 120 - 130 | 77 - 96 | 0.24 - 0.36 | 248 - 266 | 200 - 250 | 0.6 - 0.9 |
| HDPE | 0.940 - 0.965 | 120 - 128 | 58 | 0.16 - 0.32 | 248 - 262 | 150 | 0.4 - 0.8 |
| mLLDPE | 0.915 - 0.940 | 116 - 123 | 233 - 775 | - | 241 - 253 | 400 - 700 | - |
| PP | 0.890 - 0.903 | 156 - 167 | 58 | 0.28 | 313 - 333 | 150 | 0.7 |
| PA 6 | 1.120 - 1.140 | 210 - 220 | 1.0 | 4.00 - 8.00 | 410 - 428 | 2.6 | 10.0 - 20.0 |
| PA 6,66 | 1.120 - 1.140 | 193 - 198 | 1.0 | 4.00 - 8.00 | 379 - 388 | 2.6 | 10.0 - 20.1 |
| EVOH | 1.140 - 1.160 | 165 - 183 | 0.008 | 0.80 - 1.80 | 329 - 361 | 0.02 | 2.0 - 4.5 |
| PVdC | 1.690 - 1.710 | 158 - 161 | 0.058 | 0.04 | 316 - 322 | 0.15 | 0.1 |
| PS | 1.040 | - | 136 | 2.80 - 4.00 | - | 350 | 7.0 - 10.0 |
| PVC | 1.160 | - | 1.9 - 7.75 | 0.36 - 2.00 | - | 5.0 - 20.0 | 0.9-5.1 |
| PVdF | 1.780 | 134 - 171 | - | - | 273 - 340 | - | - |
| PAN (Barex) | 1.150 | 174 - 178 | 0.3 | 2.00 | 345 - 352 | 0.8 | 5.0 |
| SBC (K-Resin) | 1.020 | - | 107 - 164 | 1.40 - 2.20 | - | 276 - 424 | 3.5 - 5.5 |
| Ionomer (Surllyn) | 0.940 - 0.950 | 92-96 | 78 - 194 | 0.40 - 3.60 | 198 - 205 | 200 - 500 | 1.0 - 9.0 |

¹ OTR: cm³ * mm/m² / 24h @ 23°C, 0% RH ² WVTR: g*mm/m² / 24h @ 37.8°C, 90% RH ³ OTR: cm³ * mil/100 in² / 24h @ 1.0 mil, 73.4°F, 0% RH ⁴ WVTR: g*mil/100 in² / 24h @ 1.0 mil, 100°F, 90% RH

Adhesion Strength

| | LDPE | LLDPE | HDPE | mPE | EVA | PP | EVOH | PA | Ionomer Na | Ionomer Zn | PS | SBC | PETG | PVdC |
|------------|------|-------|------|-----|-----|----|------|----|------------|------------|----|-----|------|------|
| | | | | | | | | | | | | | | |
| LDPE | G | | | | | | | | | | | | | |
| LLDPE | G | G | | | | | | | | | | | | |
| HDPE | G | G | G | | | | | | | | | | | |
| mPE | G | G | G | G | | | | | | | | | | |
| EVA | G | G | G | G | G | | | | | | | | | |
| PP | F | G | F | G | G | G | | | | | | | | |
| EVOH | P | P | P | P | P | P | G | | | | | | | |
| PA | P | P | P | P | P | P | G | G | | | | | | |
| Ionomer Na | P | P | P | F | F | P | P | P | G | | | | | |
| Ionomer Zn | F | F | P | F | F | P | P | P | G | G | | | | |
| PS | P | P | P | P | P | P | P | P | P | P | G | | | |
| SBC | P | P | P | F | P | P | P | P | P | P | G | G | | |
| PETG | P | P | P | P | P | P | P | P | P | P | P | P | G | |
| PVdC | P | P | P | P | G | P | P | P | P | P | P | P | P | G |

Roll Weight (kg)

| Width (mm) | Roll Diameter (mm) | | | | | | | |
|------------|--------------------|-----|-----|------|------|------|------|------|
| | 200 | 400 | 600 | 800 | 1000 | 1200 | 1400 | 1500 |
| 500 | 12 | 56 | 128 | 229 | 359 | 518 | - | - |
| 800 | 20 | 89 | 205 | 367 | 575 | 829 | 1129 | - |
| 1000 | 25 | 112 | 256 | 458 | 718 | 1036 | 1411 | 1621 |
| 1200 | 30 | 134 | 307 | 550 | 862 | 1243 | 1694 | 1945 |
| 1500 | 37 | 167 | 384 | 687 | 1077 | 1554 | 2117 | 2431 |
| 2000 | 50 | 223 | 512 | 916 | 1436 | 2072 | 2823 | 3242 |
| 2500 | 62 | 279 | 640 | 1145 | 1795 | 2590 | 3529 | 4052 |

Roll Weight (lb)

| Width (in) | Roll Diameter (in) | | | | | | | |
|------------|--------------------|-----|------|------|------|------|------|-------|
| | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |
| 20 | 45 | 110 | 200 | 320 | 460 | 825 | - | - |
| 40 | 90 | 220 | 400 | 640 | 920 | 1650 | 2600 | - |
| 60 | 135 | 330 | 600 | 960 | 1380 | 2475 | 3900 | 5610 |
| 80 | 180 | 440 | 800 | 1280 | 1840 | 3300 | 5200 | 7480 |
| 100 | 225 | 550 | 1000 | 1600 | 2300 | 4125 | 6500 | 9350 |
| 120 | 270 | 660 | 1200 | 1920 | 2760 | 4950 | 7800 | 11220 |
| 140 | 315 | 770 | 1400 | 2240 | 3220 | 5775 | 9100 | 13090 |

Film Yield (m²/kg)

| Density (g/cm ³) | Thickness (µm) | | | | | | |
|------------------------------|----------------|------|------|------|------|------|------|
| | 10 | 25 | 35 | 50 | 75 | 100 | 150 |
| 0.90 | 111.1 | 44.4 | 31.7 | 22.2 | 14.8 | 11.1 | 7.41 |
| 0.92 | 108.7 | 43.5 | 31.1 | 21.7 | 14.5 | 10.9 | 7.25 |
| 0.95 | 105.3 | 42.1 | 30.1 | 21.0 | 14.0 | 10.5 | 7.02 |
| 0.98 | 102.0 | 40.8 | 29.1 | 20.4 | 13.6 | 10.2 | 6.80 |
| 1.00 | 100.0 | 40.0 | 28.6 | 20.0 | 13.3 | 10.0 | 6.67 |
| 1.10 | 90.9 | 36.4 | 26.0 | 18.2 | 12.1 | 9.09 | 6.06 |
| 1.20 | 83.3 | 33.3 | 23.8 | 16.7 | 11.1 | 8.33 | 5.56 |

Film Yield (in²/lb)

| Density (g/cm ³) | Thickness (mil) | | | | | | |
|------------------------------|-----------------|-------|-------|-------|-------|------|------|
| | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 | 4.0 | 6.0 |
| 0.90 | 61512 | 30756 | 20504 | 15378 | 10252 | 7689 | 5126 |
| 0.92 | 60174 | 30087 | 20058 | 15044 | 10029 | 7522 | 5015 |
| 0.95 | 58274 | 29137 | 19425 | 14569 | 9712 | 7284 | 4856 |
| 0.98 | 56490 | 28245 | 18830 | 14123 | 9415 | 7061 | 4708 |
| 1.00 | 55360 | 27680 | 18453 | 13840 | 9227 | 6920 | 4613 |
| 1.10 | 50328 | 25164 | 16776 | 12582 | 8388 | 6291 | 4194 |
| 1.20 | 46134 | 23067 | 15378 | 11533 | 7689 | 5767 | 3844 |